THE WEATHER AND CIRCULATION OF APRIL 1950[1]

JAY S. WINSTON

Extended Forecast Section, U. S. Weather Bureau

Washington, D. C.

The basic pattern of the upper level circulation during April 1950 over North America consisted of a deep trough in eastern sections and a ridge in western sections of the continent (fig. 1). 700-mb. heights in the trough were below normal from James Bay southward to Florida and above normal east of Hudson Bay. These height anomalies were also extensive in a longitudinal direction on either side of the trough with negative departures stretching at middle latitudes (30°–50° N.) from the western Atlantic Ocean to the Plains States, and with positive departures extending zonally from central Canada to southern Greenland. In the ridge 700-mb. heights were above normal in northwestern Canada and along the Pacific coast of the United States south of 45° N., and below normal in southwestern Canada. Also of direct importance in its effects on United States weather was the deep low in the Gulf of Alaska and the trough to its south. Below-normal heights in this low, combined with positive height anomalies in the ridge along the Pacific coast, led to stronger-than-normal maritime flow into Washington, Oregon, and British Columbia.

Some other features of the circulation are of interest, although their influence on the United States area was not very significant during April. These were the extensive ridge in the Atlantic Ocean and the deep trough in western Europe and northwestern Africa. The split westerlies in mid-Atlantic, with the northern branch of the flow between about 50° and 70° N. and the southern branch at about 25° to 35° N. going into Africa, were indicative that this ridge was of a blocking type. The

[1] See Charts I–XI following p. 74 for analyzed climatological data for the month.

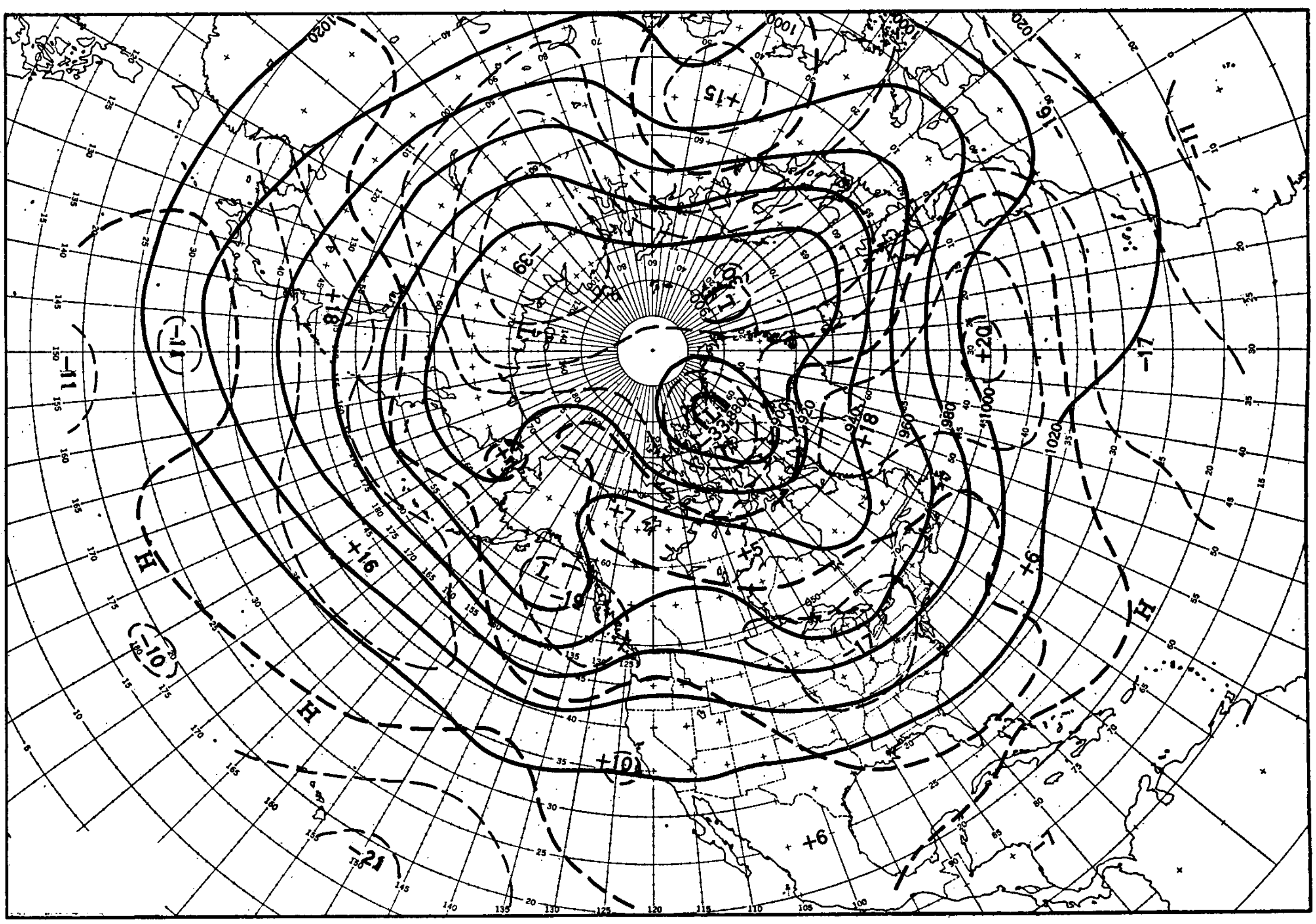


FIGURE 1.—Mean 700-mb. chart for the 30-day period March 28 to April 26, inclusive. Contours at 200-foot intervals are shown by solid lines, 700-mb. height departure from normal at 100-foot intervals by dashed lines with the zero isopleth heavier. Anomaly centers and contours are labeled in 10's of feet.

positive height center at 45° N., 30° W. was directly north of a negative height center at 30° N. Thus, the westerly flow was considerably weaker than normal between 30° and 50° N. in the eastern Atlantic.

The temperature anomaly pattern for the month (Chart I) was very similar to that of the previous month (see Chart I in March 1950 Monthly Weather Review). This persistence was directly associated with the general persistence of the basic circulation pattern over North America during March and April. Thus, above-normal 700-mb. heights in Canada and below-normal heights along the Canadian-United States border and throughout the eastern two-thirds of the United States resulted in repeated outbreaks of cold Canadian Polar air into central and eastern United States. At sea level a well-defined ridge extended from the Dakotas southeastward through Iowa and Missouri into the Southeast (Chart VI). Pressures in this ridge were more than 2 mb. above normal from the Canadian border to the Gulf coast (Chart II inset). The isopleths of sea level pressure anomaly show that the flow out of Canada was considerably stronger than normal in Minnesota and Wisconsin where the coldest temperature anomalies in the entire United States were observed—as much as 10° F. below normal, the coldest on record in that area for April. Chart VI indicates that this cold air at sea level came from the northeast, almost directly from the frozen Hudson Bay region.

The anticyclone tracks (Chart II) show that the highs associated with this cold weather originated in both the Pacific Ocean and Canada, and generally moved southeastward through the middle sections of the country (on the average near the mean sea level ridge mentioned above). A few high cells also moved eastward across Canada. The one which started in the Yukon on the 5th was very intense and extensive in a meridianal direction, and was responsible for a very severe outbreak of cold air in all of the United States east of the Rockies. The highs moving into the Pacific Northwest contributed to the cold weather experienced there during April. In addition, the stronger-than-normal onshore flow of cool Pacific air aloft mentioned earlier and the abnormally high monthly mean sea level pressure (Charts VI and II inset) were associated with these subnormal temperatures. Temperatures in New England and along most of the immediate east coast as far south as the Carolinas averaged very close to normal. This area was close to and slightly east of the 700-mb. trough, and was located under a weak southerly flow relative to normal. Above-normal temperatures were confined to the Southwest where 700-mb. heights were above normal and where the thermal low at the surface was very well developed (Charts VI and II inset).

Precipitation was generally deficient in the West and throughout the central and southern Plains (Chart V and inset). This was associated with general ridge conditions at 700 mb. and the abnormally strong northwesterly flow east of the ridge. However, rainfall was generally heavy in coastal sections of Washington due to the strong onshore flow from the trough in the eastern Pacific. The rapid fall-off in the precipitation to lighter-than-normal amounts in eastern Washington may be ascribed to the influence of the anticyclonic circulation aloft. Above-normal precipitation in Montana and the Dakotas occurred with northwesterly flow aloft (fig. 1) and easterly and southeasterly flow at the surface (Chart VI). Much of this precipitation was in the form of snow (Chart VII) and was caused primarily by Pacific maritime Polar air overrunning the cold Polar domes banked against the Continental Divide. At many points in this region, the amounts of snow for this month were at least as great as the amounts in either January or February 1950.

In the Great Lakes region precipitation amounts were heavier than normal under the pronounced cyclonic circulation aloft in the vicinity of the deep trough at 700 mb. (fig. 1). The cyclone paths in Chart III indicate that surface cyclonic activity was frequent in this region during April. Further evidence of this cyclonic activity may be found on the mean sea level map (Chart VI) where a pronounced low was centered in western Michigan with sharp cyclonic curvature throughout the surrounding region. It is also interesting to note that a center of low percentage of clear sky for the month was located in southern Michigan close to the sea level low center and in the region of heavy precipitation (Chart IV). Lighter-than-normal precipitation over much of the Appalachians and along the east coast as far south as the Carolinas was related to the unusual tilt of the upper level trough in a northwest-southeast direction.[2] This tilt was probably associated with the fact that east coast storms moved either away from the coast in a straight easterly direction or northward at a considerable distance from the coast (Chart III) so that few cyclones passed through this entire region. The several east coast cyclones that developed in southern New England and off the New Jersey coast between the 9th and 13th produced snowfall in southern sections of New England and New York (Chart VII) which exceeded the total amounts for January 1950. However, the amount of this snowfall was very small in terms of the normal April precipitation for this area.

The heavy rain in the Gulf States is difficult to explain from the cyclone tracks since no low centers passed through that region. It was probably associated with the frequent occurrence of quasi-stationary frontal zones in this region between the cold Polar air and the warm maritime Tropical air. The temperature anomaly in Texas (Chart I) gives some evidence for such a mean frontal zone with above-normal temperatures at Brownsville and Corpus Christi and below-normal temperatures near Houston and Galveston.

[2] Trough tilt on 5-day mean 700-mb. charts was found to be an important parameter related to 5-day precipitation amounts in the Tennessee Valley by Klein. See "An Objective Method of Forecasting Five-Day Precipitation for the Tennessee Valley," William H. Klein, U. S. Weather Bureau *Research Paper No. 29*, April 1949.

Chart I. Departure (°F.) of the Mean Temperature from the Normal, and Wind Roses for Selected Stations, April 1950

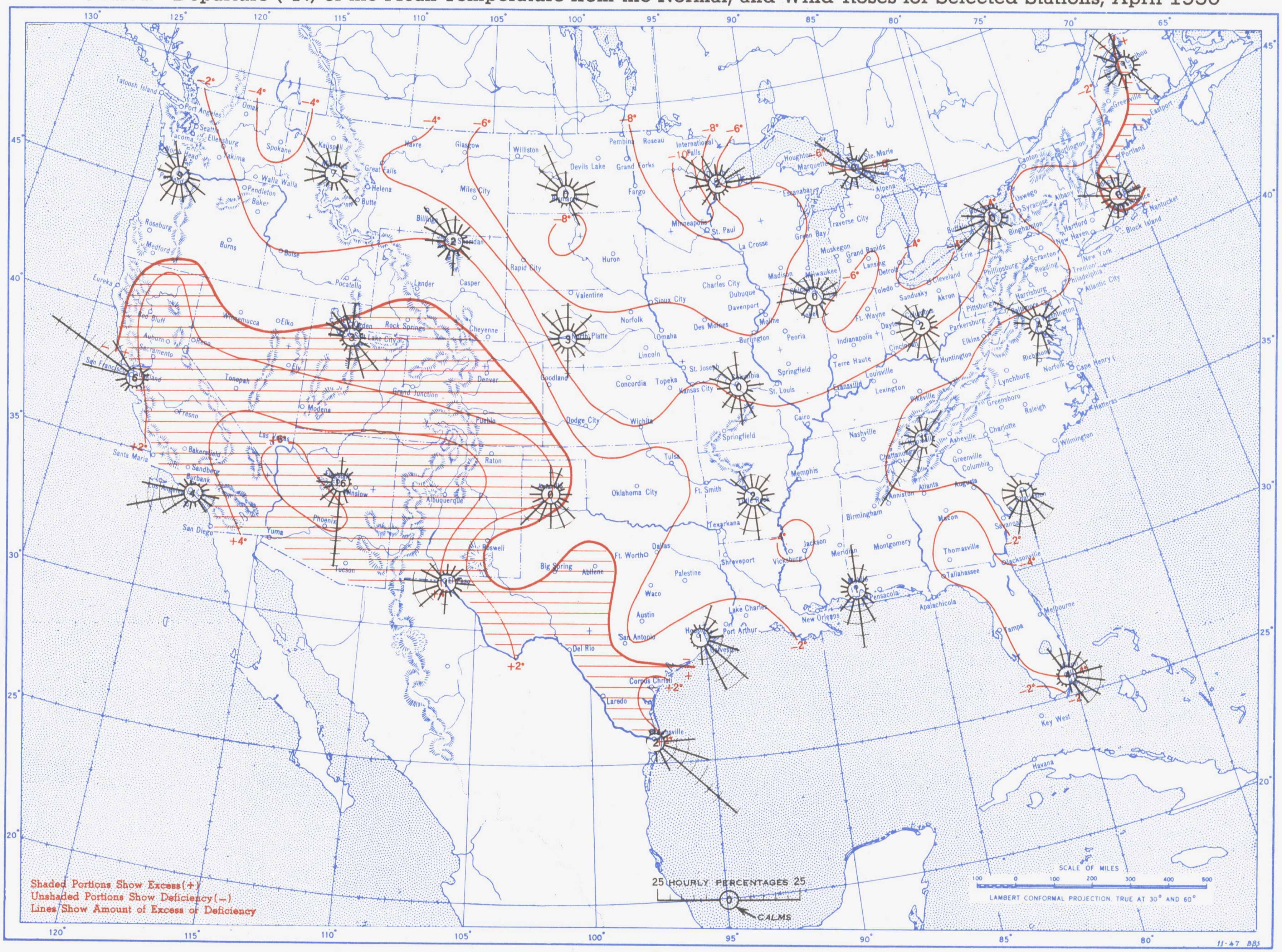
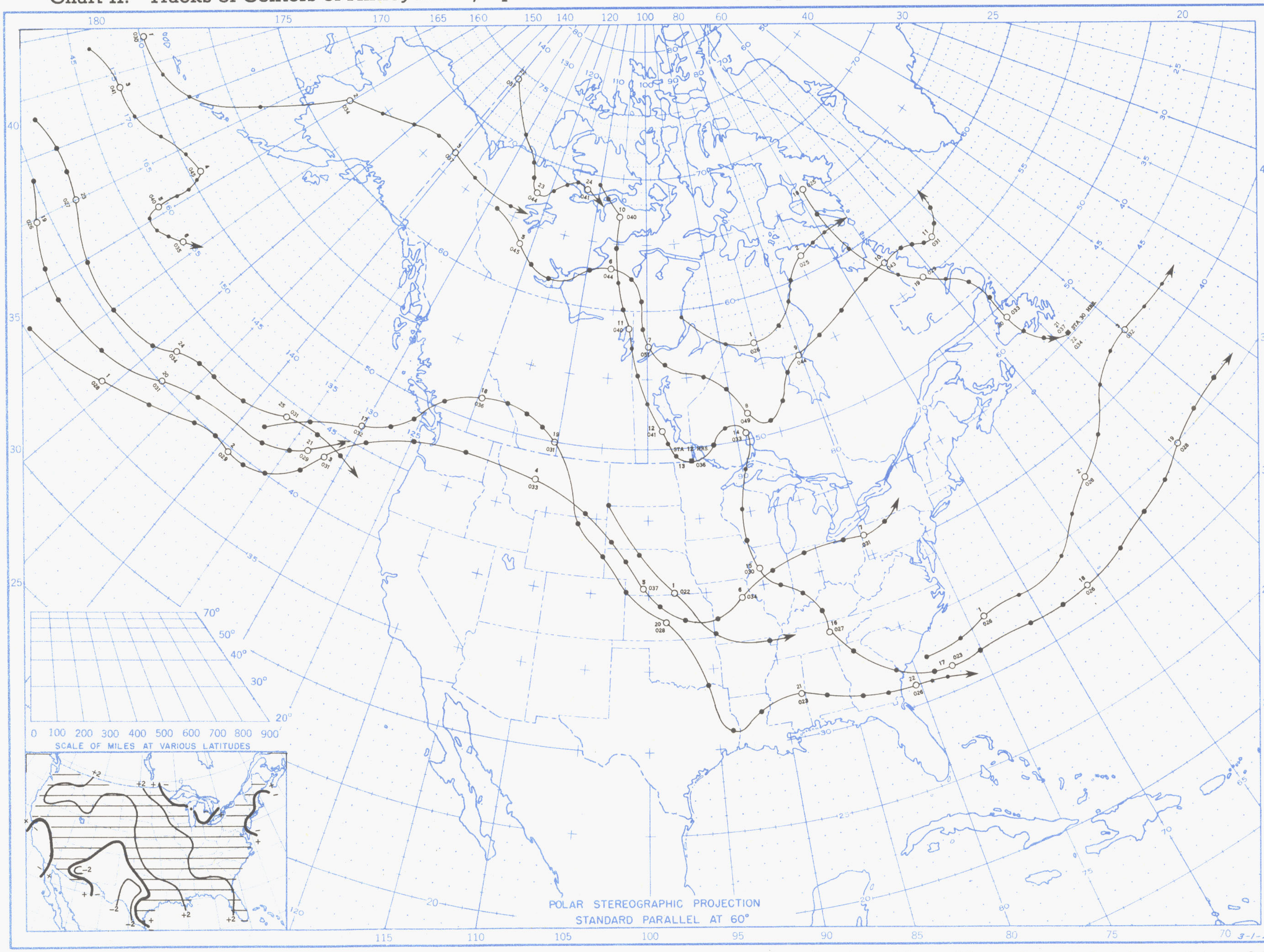
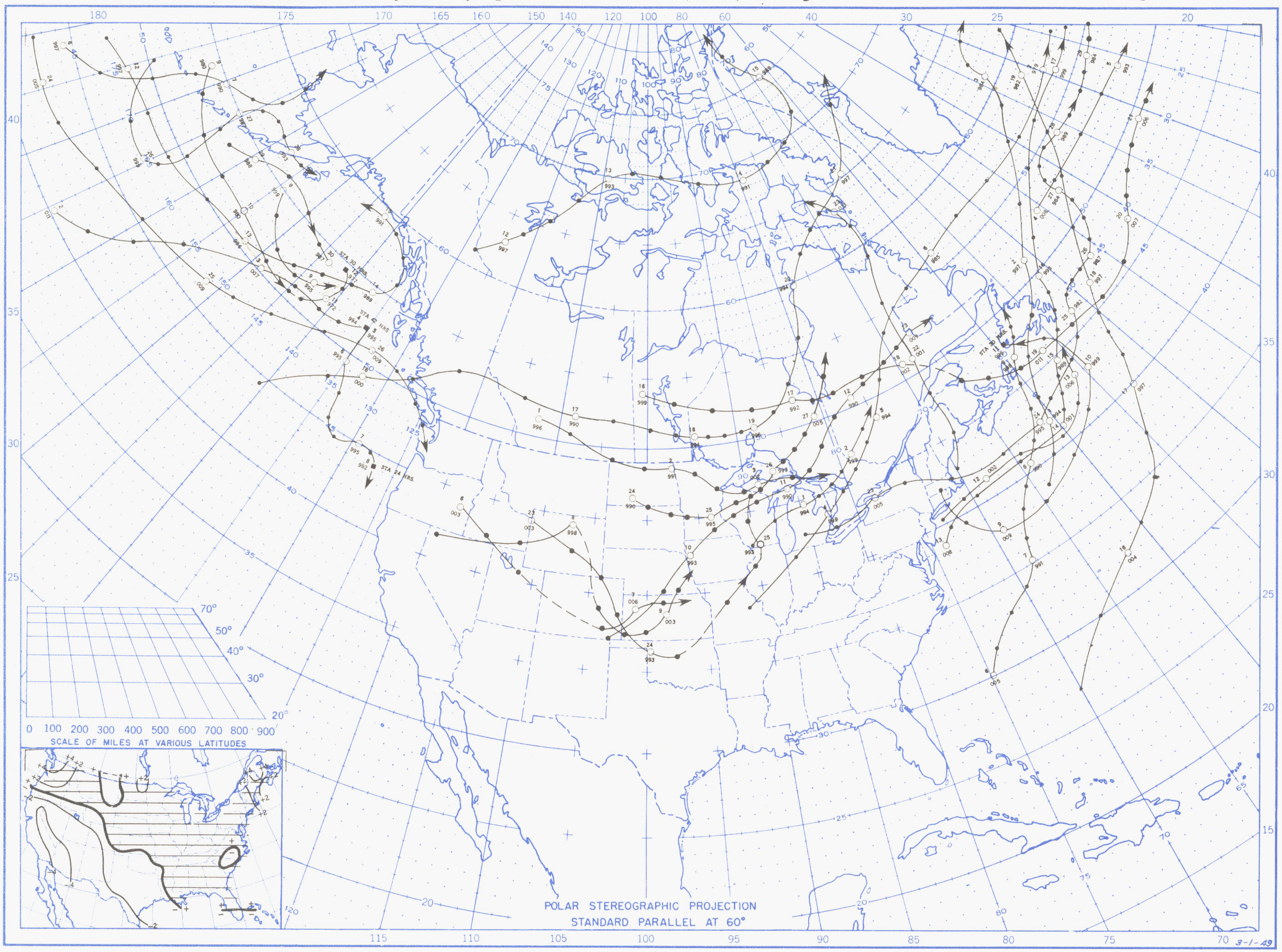


Chart II. Tracks of Centers of Anticyclones, April 1950. (Inset) Departure of Monthly Mean Pressure from Normal



Circle indicates position of anticyclone at 7:30 a. m. (75th meridian time). Dots indicate intervening 6-hourly positions. Figure above circle indicates date, and figure below, pressure to nearest millibar. Only those centers which could be identified for 24 hours or more are included.

Chart III. Tracks of Centers of Cyclones, April 1950. (Inset) Change in Mean Pressure from Preceding Month



Circle indicates position of cyclone at 7:30 a. m. (75th meridian time) Dots indicate intervening 6-hourly positions. Figure above circle indicates date, and figure below, pressure to nearest millibar. Only those centers which could be identified for 24 hours or more are included.

Chart IV. Percentage of Clear Sky Between Sunrise and Sunset, April 1950

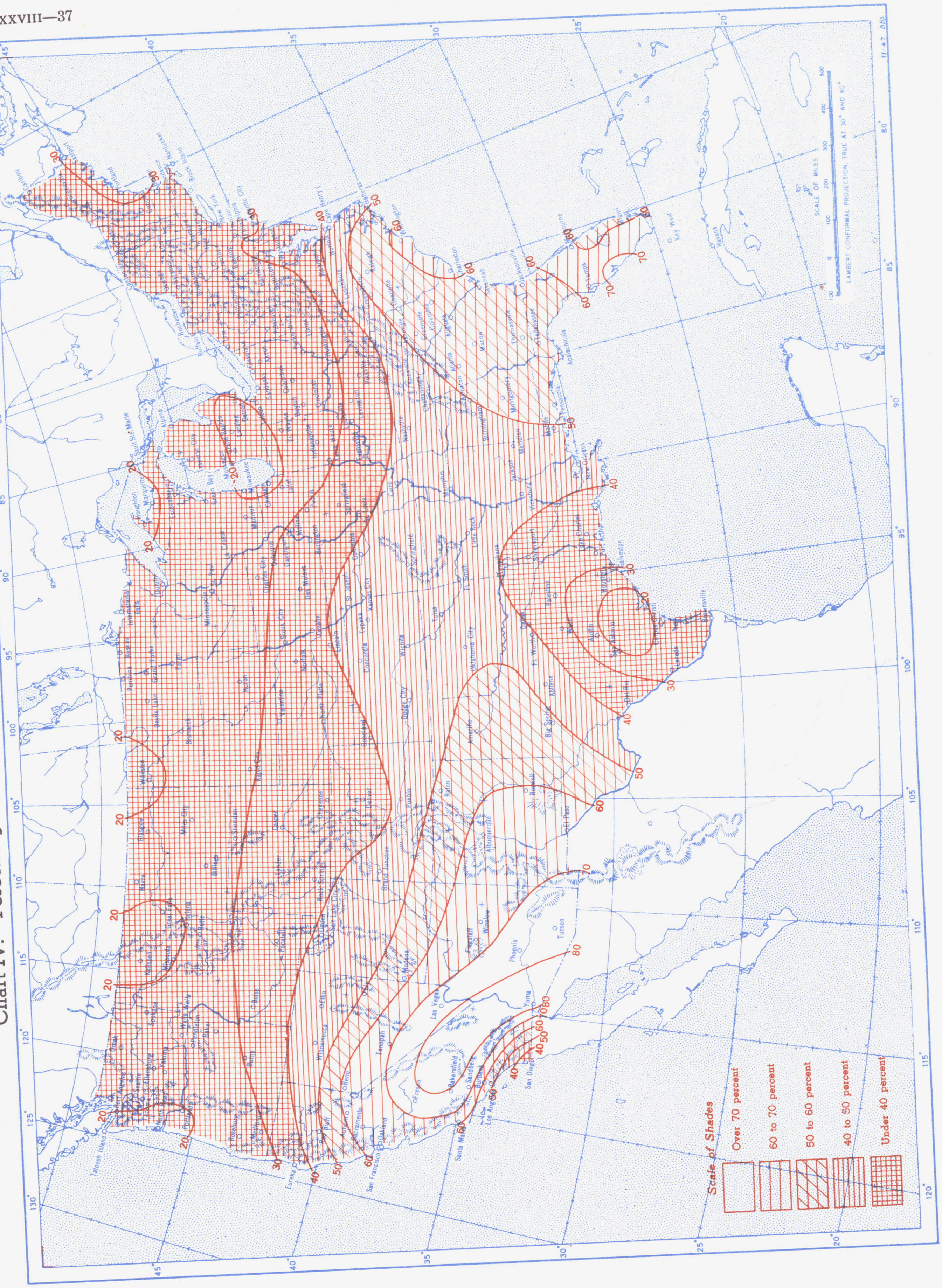
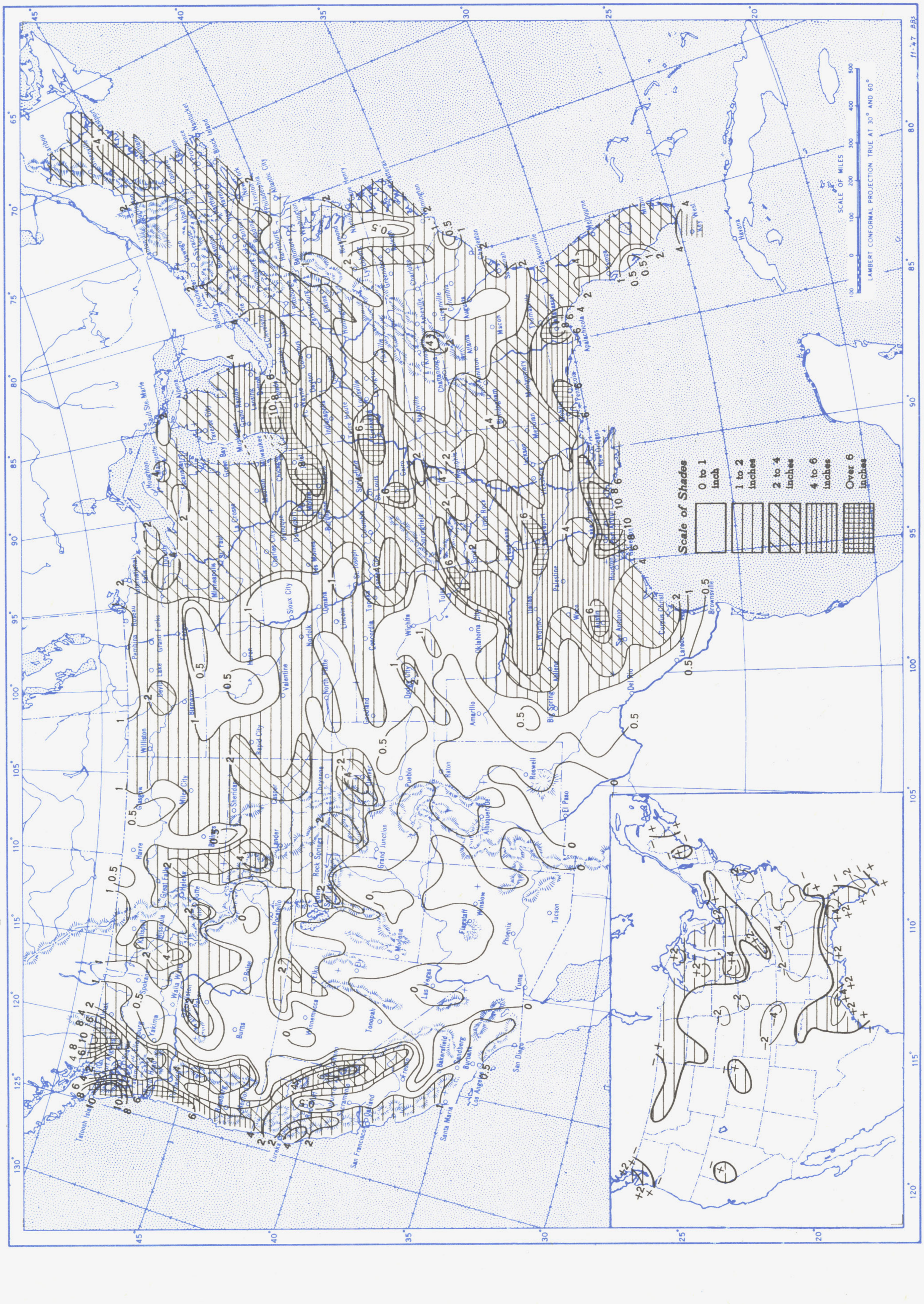


Chart V. Total Precipitation, Inches, April 1950. (Inset) Departure of Precipitation from Normal



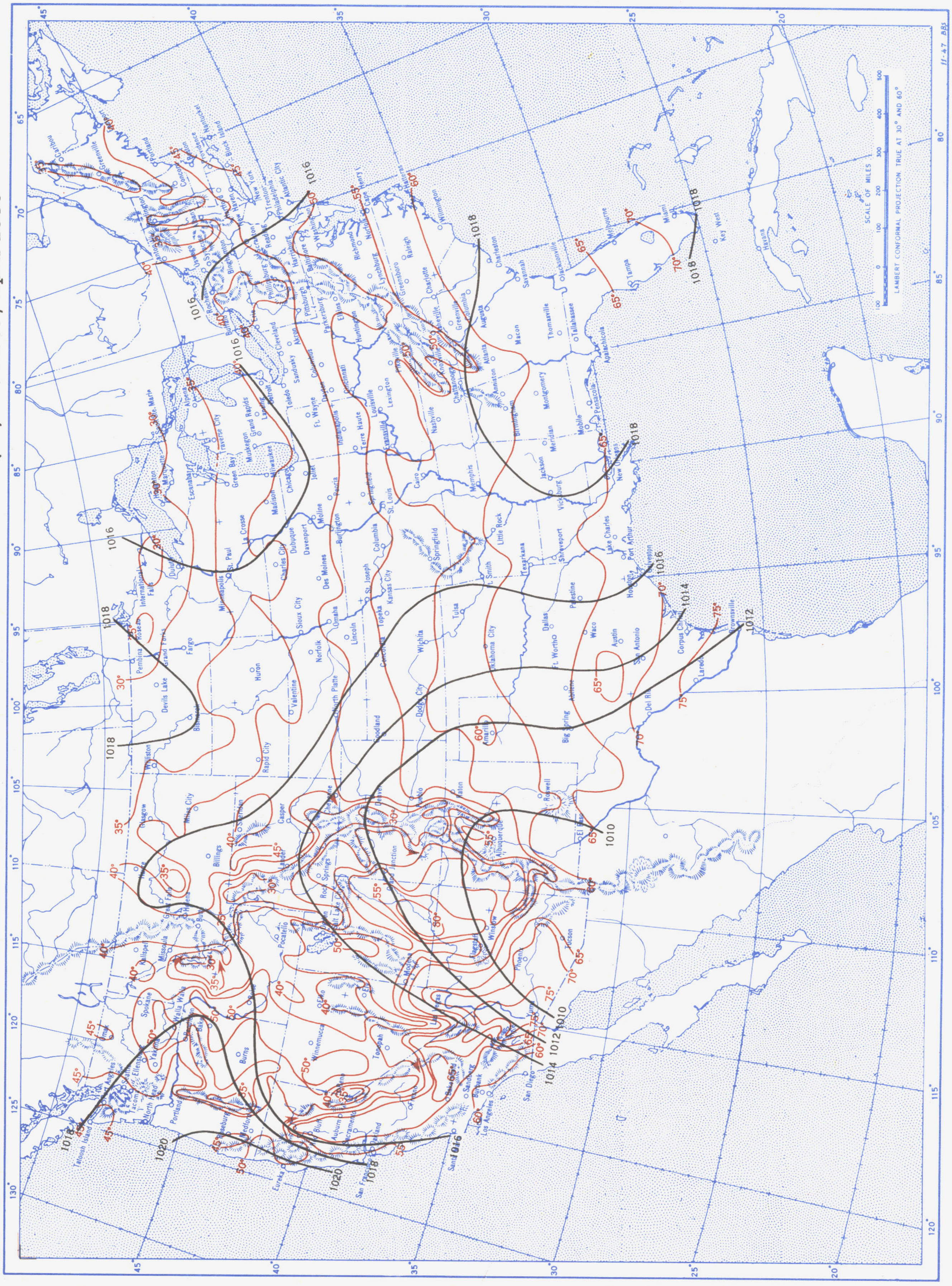


Chart VI. Mean Isobars (mb.) at Sea Level and Mean Isotherms (°F.) at Surface., April 1950

Chart VII. Total Snowfall, Inches, April 1950.

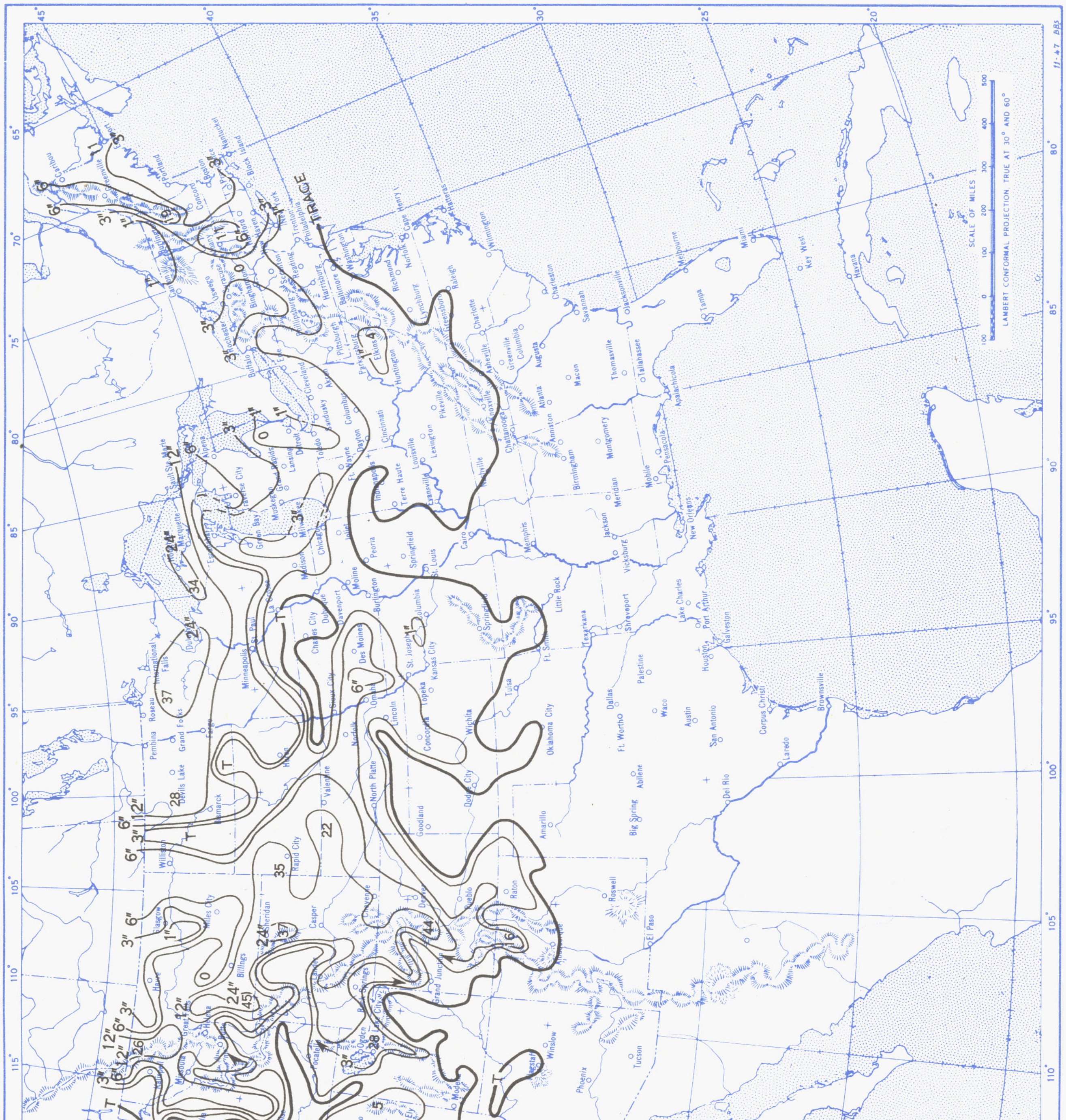
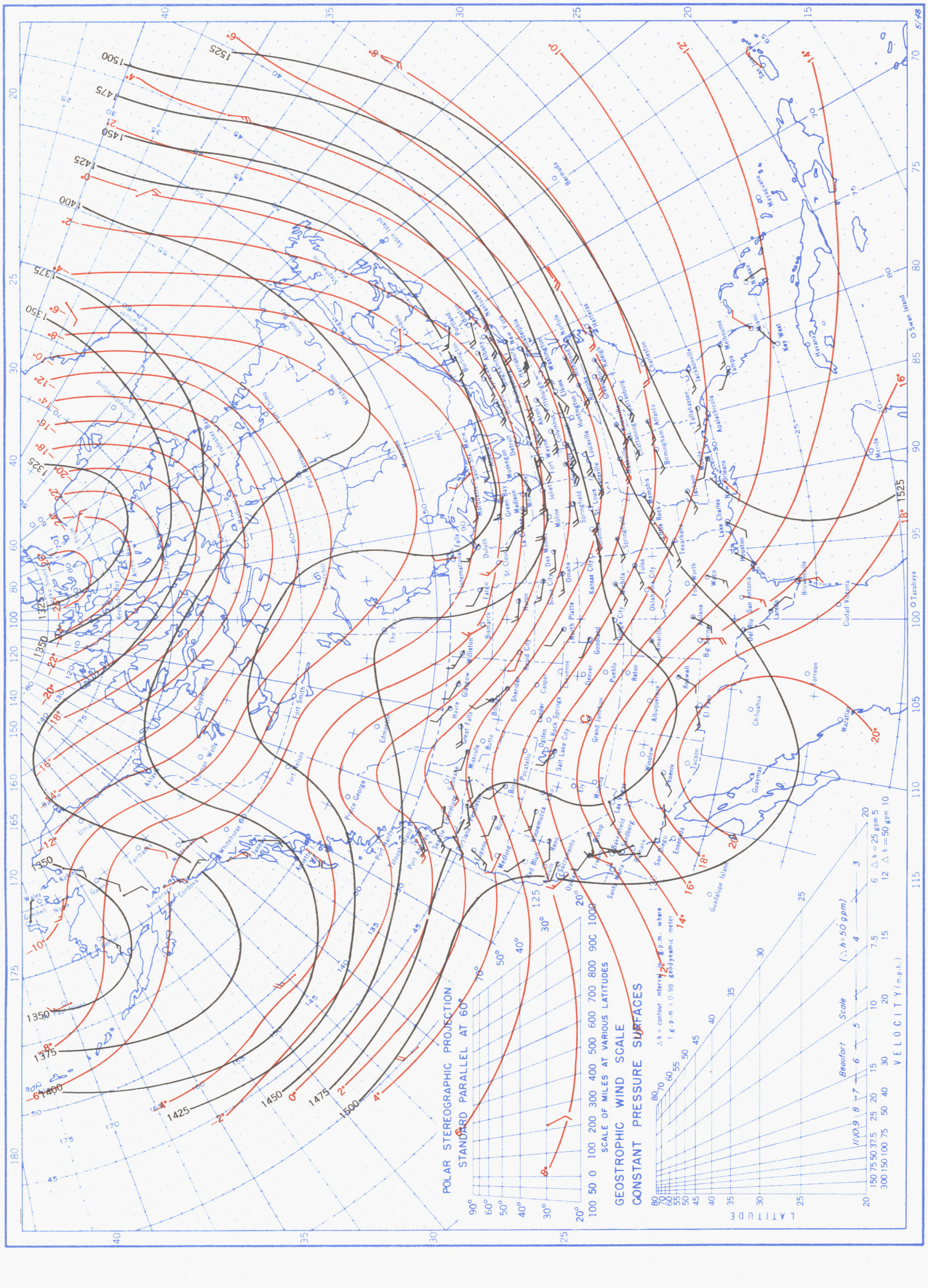
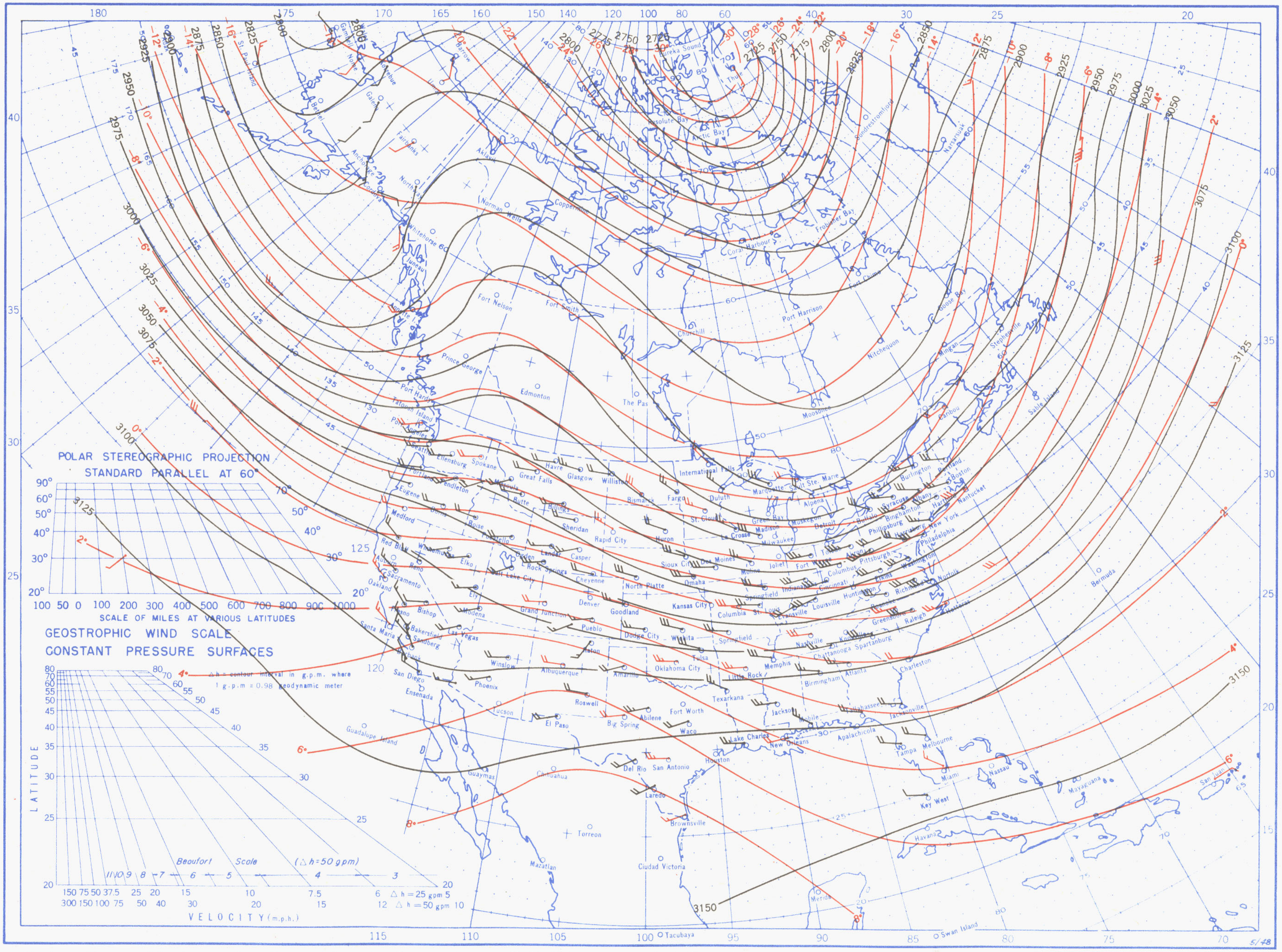


Chart VIII, April 1950. Contour Lines of Mean Dynamic Height (Geopotential) in Units of 0.98 Dynamic Meters and Mean Isotherms in Degrees Centigrade for the 850-millibar Pressure Surface, and Resultant Winds at 1,500 Meters (m. s. l.)



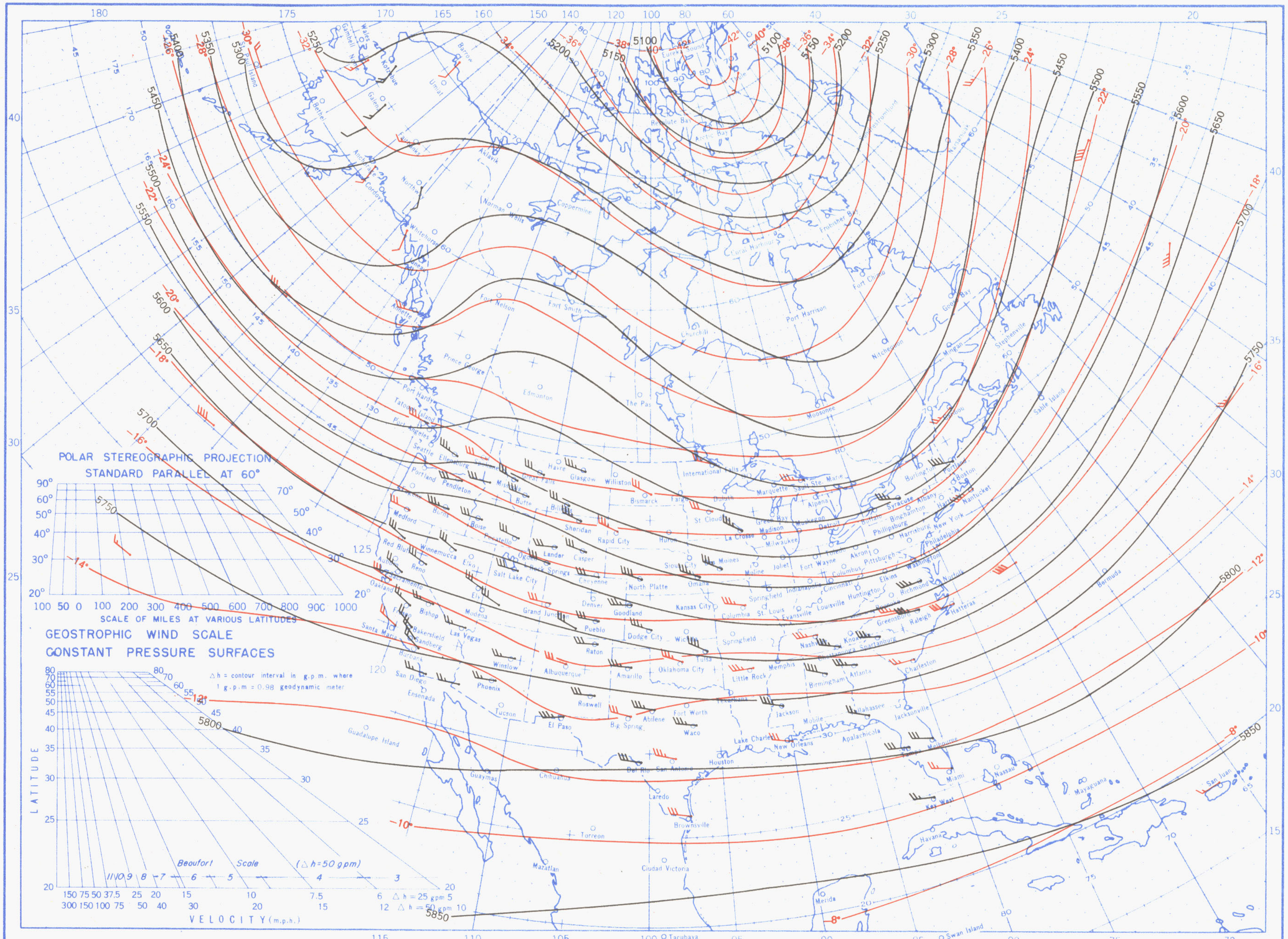
Contour lines and isotherms based on radiosonde observations at 0300 G. C. T. Winds indicated by black arrows based on pilot balloon observations at 2100 G. C. T.; those indicated by red arrows based on rawins taken at 0300 G. C. T.

Chart IX, April 1950. Contour Lines of Mean Dynamic Height (Geopotential) in Units of 0.98 Dynamic Meters and Mean Isotherms in Degrees Centigrade for the 700-millibar Pressure Surface, and Resultant Winds at 3,000 Meters (m. s. l.)



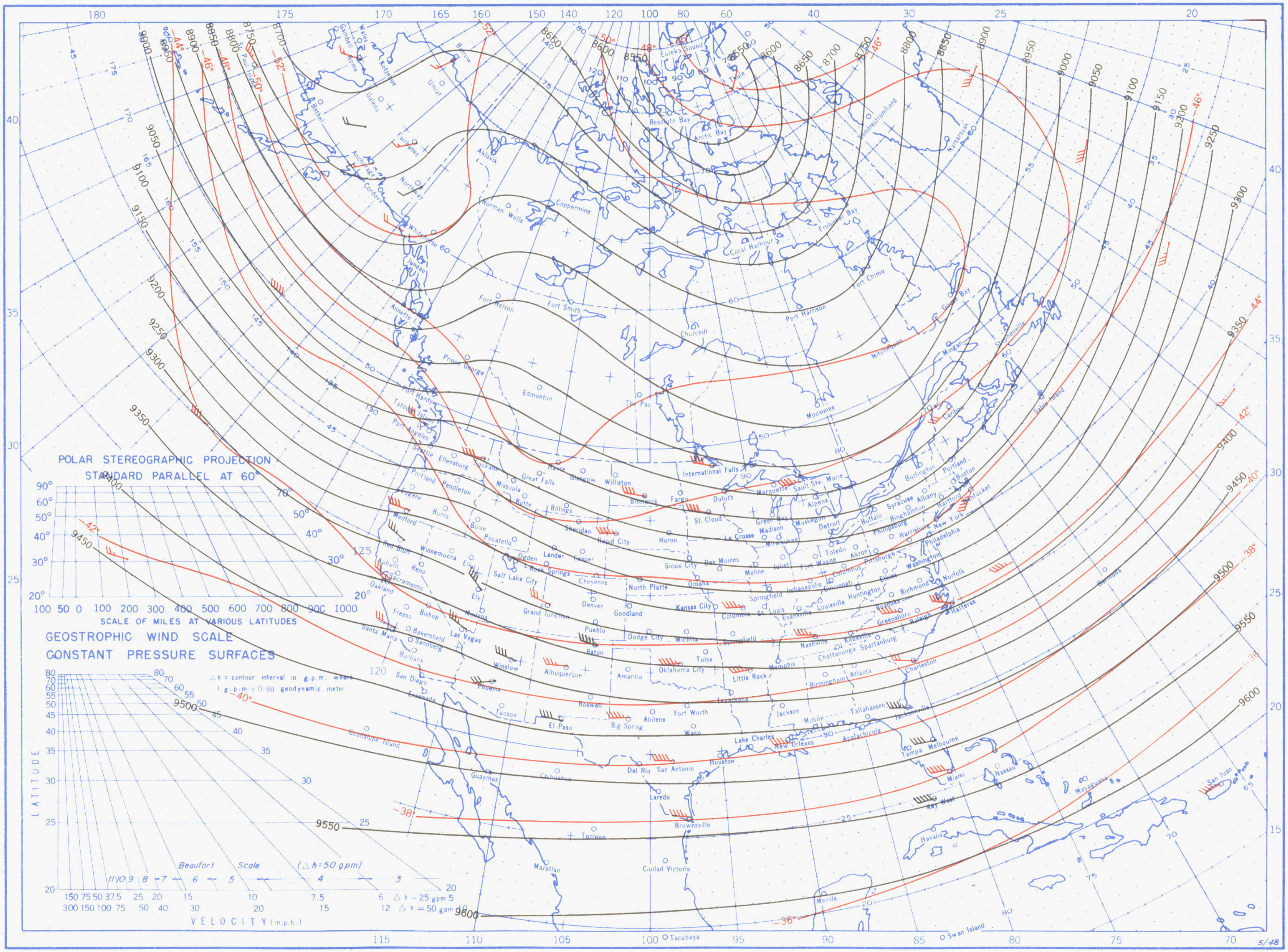
Contour lines and isotherms based on radiosonde observations at 0300 G. C. T. Winds indicated by black arrows based on pilot balloon observations at 2100 G. C. T.; those indicated by red arrows based on rawins taken at 0300 G. C. T.

Chart X, April 1950. Contour Lines of Mean Dynamic Height (Geopotential) in Units of 0.98 Dynamic Meters and Mean Isotherms in Degrees Centigrade for the 500-millibar Pressure Surface, and Resultant Winds at 5,000 Meters (m. s. l.)



Contour lines and isotherms based on radiosonde observations at 0300 G. C. T. Winds indicated by black arrows based on pilot balloon observations at 2100 G. C. T.; those indicated by red arrows based on rawins taken at 0300 G. C. T.

Chart XI, April 1950. Contour Lines of Mean Dynamic Height (Geopotential) in Units of 0.98 Dynamic Meters and Mean Isotherms in Degrees Centigrade for the 300-millibar Pressure Surface, and Resultant Winds at 10,000 Meters (m. s. l.)



Contour lines and isotherms based on radiosonde observations at 0300 G. C. T. Winds indicated by black arrows based on pilot balloon observations at 2100 G. C. T.; those indicated by red arrows based on rawins taken at 0300 G. C. T.